

IAP12 Rec'd PCT/PTO 04 MAY 2006

DOCKET: CU-4797

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Seiji TAWAKAYA et al

TITLE: LIQUID CRYSTAL DISPLAY APPARATUS

THE COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDED CLAIMS

1-9. (cancelled)

10. (new) A liquid crystal display apparatus comprising at least two sheets of transparent substrates, a liquid crystal layer sealed between the two sheets of transparent substrates, and a plurality of columnar spacers formed between the two sheets of transparent substrates for keeping a gap between the two sheets of transparent substrates at a specified gap,

wherein a displacement amount between an 80 mN to 400 mN load is in a range of 0.1 mm to 0.8 mm, and a displacement amount between a 600 mN to 950 mN load is in a range of 0.05 mm to 0.5 mm at a time of applying a load by a measurement method in a direction so as to reduce the gap between the two sheets of transparent substrates to a display area of the two sheets of transparent substrates;

wherein, by the measurement method, a deformation amount against the load is measured by applying the load in a vertical direction to a transparent substrate surface with an indenter having a 2 mm ϕ plane by a 2.22 mN/sec applied load contacted with either of the transparent substrate side under a 23°C condition.

11. (new) A liquid crystal display apparatus comprising at least two sheets of transparent substrates, a liquid crystal layer sealed between the two sheets of transparent substrates, and a plurality of columnar spacers formed between the two sheets of transparent substrates for keeping a gap between the two sheets of transparent substrates at a specified gap,

wherein with a premise that a displacement amount between an 80 mN to 400 mN load is 100, a displacement amount between a 600 mN to 950 mN load is in a range of 30 to 200 at a time of applying a load by a measurement method in a direction so as to reduce the gap between the two sheets of transparent substrates to a display area of the two sheets of transparent substrates;

wherein, by the measurement method, a deformation amount against the load is measured by applying the load in a vertical direction to a transparent substrate surface with an indenter having a 2 mmf plane by a 2.22 mN/sec applied load contacted with either of the transparent substrate side under a 23°C condition.

12. (new) The liquid crystal display apparatus according to claim 10, wherein the plurality of columnar spacers formed so as to be distributed homogenously in the display area are at least two kinds of columnar spacers having different heights.

13. (new) The liquid crystal display apparatus according to claim 11, wherein the plurality of columnar spacers formed so as to be distributed homogenously in the display area are at least two kinds of columnar spacers having different heights.

14. (new) The liquid crystal display apparatus according to claim 12, wherein the at least two kinds of the columnar spacers having different heights are formed with one kind of material such that the height difference as the columnar spacers can be provided in accordance with a presence or an absence of a pedestal or by a height difference of the pedestal.

15. (new) The liquid crystal display apparatus according to claim 13, wherein the at least two kinds of the columnar spacers having different heights are formed with one kind of material such that the height difference as the columnar spacers can be provided in accordance with a presence or an absence of a pedestal or by a height difference of the pedestal.

16. (new) The liquid crystal display apparatus according to claim 14, wherein the pedestal is formed of at least one kind of layer selected from a group consisting of a colored layer, a light shielding layer and an over coat layer.

17. (new) The liquid crystal display apparatus according to claim 15, wherein the pedestal is formed of at least one kind of layer selected from a group consisting of a colored layer, a light shielding layer and an over coat layer.

18. (new) The liquid crystal display apparatus according to claim 12, wherein the at least two kinds of the columnar spacers having different heights are formed with at least two kinds of materials having different hardness such that a lower hardness material is used for a higher columnar space.

19. (new) The liquid crystal display apparatus according to claim 13, wherein the at least two kinds of the columnar spacers having different heights are formed with at least two kinds of materials having different hardness such that a lower hardness material is used for a higher columnar space.

20. (new) The liquid crystal display apparatus according to claim 12, wherein the at least two kinds of the columnar spacers having different heights have at least two kinds of shapes with different upper bottom surface areas such that a higher columnar space is formed so as to have a smaller upper bottom surface area.

21. (new) The liquid crystal display apparatus according to claim 13, wherein the at least two kinds of the columnar spacers having different heights have at least two kinds of shapes with different upper bottom surface areas such that a higher columnar space is formed so as to have a smaller upper bottom surface area.

22. (new) The liquid crystal display apparatus according to claim 12, wherein a height difference between a highest columnar space and a lowest columnar space of the at least two kinds of the columnar spacers having different heights is in a range of 0.02 mm 0.5 mm.

23. (new) The liquid crystal display apparatus according to claim 13, wherein a height difference between a highest columnar space and a lowest columnar space of the at least two kinds of the columnar spacers having different heights is in a range of 0.02 mm 0.5 mm.

24. (new) The liquid crystal display apparatus according to claim 10, wherein the plurality of columnar spacers formed in the display area is provided by laminating two kinds of materials having a same height and a different hardness respectively.

25. (new) The liquid crystal display apparatus according to claim 11, wherein the plurality of columnar spacers formed in the display area is provided by laminating two kinds of materials having a same height and a different hardness respectively.